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the patent application	עם הבקשה לפטנט
particulars of which are	לפי הפרטים הרשומים
specified on the first page	בעמוד הראשון של
of the annex.	הנספח.

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מספר: Number	
158024	
תאריך: Date	
21-09-2003	
הוקדם/נדחה Ante/Post- dated	

חוק הפטנטים, התשכ"ז-1967
PATENTS LAW, 1967-5727

בקשה לפטנט
PATENT APPLICATION

אני, (שם המבקש, מענו - ולגבי גוף מאוגד - מקום התאגדותו)
I (Name and address of applicant, and, in case of body corporate, place of incorporation)

GIDEON TAHAN
SERVISION LTD.

גדעון טחן מ.ז. 055048052
סרוויז'ן בע"מ ח.פ. 513052324
רחוב הרטום 11
הר חוצבים
ירושלים

בעל אמצאה מכח _____ ששמה הוא:
Owner, by virtue of of an invention, the title of which is:

(בעברית)
(Hebrew) חישוב גילוי תנועה מנתונים הנובעים מדוחסי ווידאו המבוססים על חיפוש וקטורי.

(באנגלית)
(English) **Deriving Motion Detection Information From Motion-Vector-Search Based Video Encoders**

hereby apply for a patent to be granted to me in respect thereof. מבקש בזאת כי ינתן לי עליה פטנט.

*בקשת חלוקה- Application for Division	*בקשת פטנט מוסף- Application for Patent of Addition	*דרישת דין קדימה Priority Claim		
מבקשת פטנט from application	לבקשה/לפטנט to Patent/Appl.	מספר/סימן Number/Mark	תאריך Date	מדינת האיגוד Convention Country
No_____ מס'	No_____ מס'			
dated_____ מיום	dated_____ מיום			
*יפוי כח: כללי/מיוחד - רצוף בזה / עוד יוגש P.O.A.: general / specific - attached / to be filed later-				
Has been filed in case_____ הוגש בענין				
המען למסירת הודעות ומסמכים בישראל Address for Service in Israel _____ רחוב הרטום 11 ת.ד. 45205 ירושלים 91450				
חתימת המבקש Signature of Applicant SERVISION LTD. 513052324 JERUSALEM ISRAE		היום 18 This 18	בחודש ספטמבר Of September	שנת 2003 of the year 2003

REFERENCE: סימוכין:

DERIVING MOTION DETECTION INFORMATION FROM MOTION-VECTOR-SEARCH TYPE VIDEO ENCODERS

Introduction:

When digital video started becoming a common product, many image processing algorithms were implemented to offer a large variety of tools. One of them is Video Motion Detection (VMD) – the ability to use digital video for detecting motion in the field-of-view. This algorithm provides a motion detection sensor for "free" – when a digital surveillance system is installed, the motion detection data is derived from the video images without any extra cost.

Digital video is usually compressed (encoded) before it is distributed. Today's methods of video encoding are usually based on Motion-Vector-Search (MVS) based video encoders. These algorithms provide high image quality at lower bit-rate, enabling distributing the video stream over lower-bandwidth networks. Examples of such algorithms are MPEG-2, MPEG-4 and H.264.

All the image processing algorithms require a substantial amount of computing power. Reducing the computing power requirements enables adding performance to existing systems and providing the same performance for less money.

The method described below enables getting "two for the price of one": on a system that uses an MVS-based compression algorithm, it enables getting VMD in almost no added processing power.

Field of Invention:

This method enables calculating motion detection inside the process of MVS-encoding a video stream, using almost no added computing power.

Prior Art:

Video Motion Detection algorithms are well known in the literature. They require 2xNxM steps for calculating, where N and M are the width and height of the image respectively. Systems that utilize them have to pay this price in computing power.

What's the Problem? (Disadvantages of existing solution):

The amount of calculations requires a lot of computing power.

Description of the Invention:

The method uses the byproducts of the MVS encoding process to mathematically derive motion detection data. Instead of 2xNxM computational steps it uses only NxM/256 up to NxM/100. The method was successfully implemented on MPEG-4, currently the de-facto standard for streaming video compression. From here on, we will use MPEG-4 as the implementation example.

Drawings:

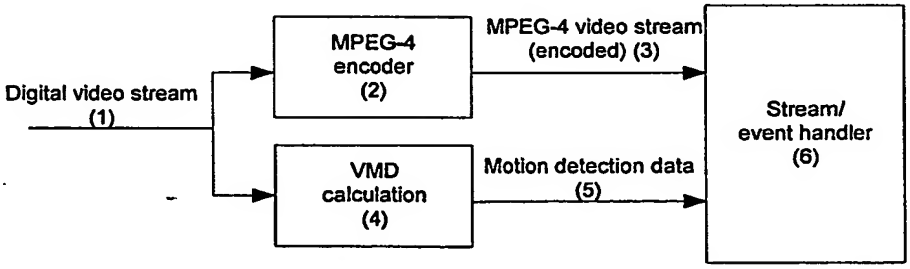

Figure 1: A block diagram of a video streaming application with VMD.

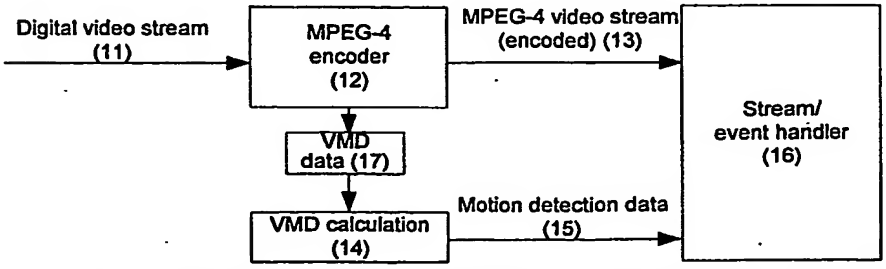

Figure 2: A block diagram of a video streaming application with VMD, new algorithm used.

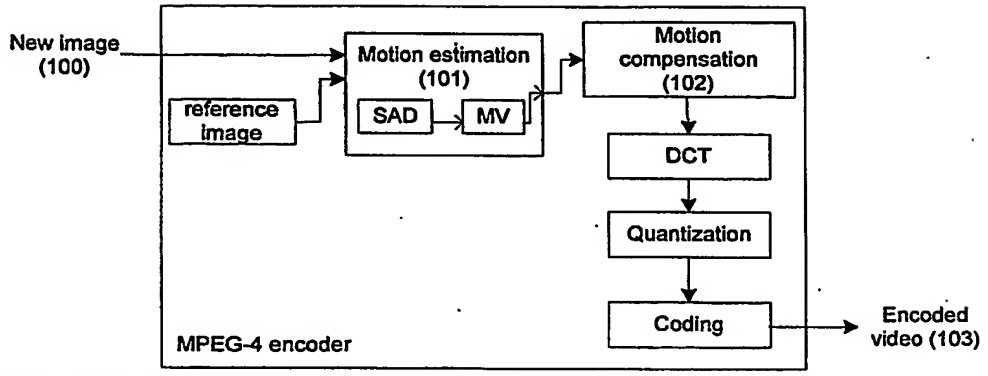

Figure 3: A block diagram of MPEG-4 data processing flow.

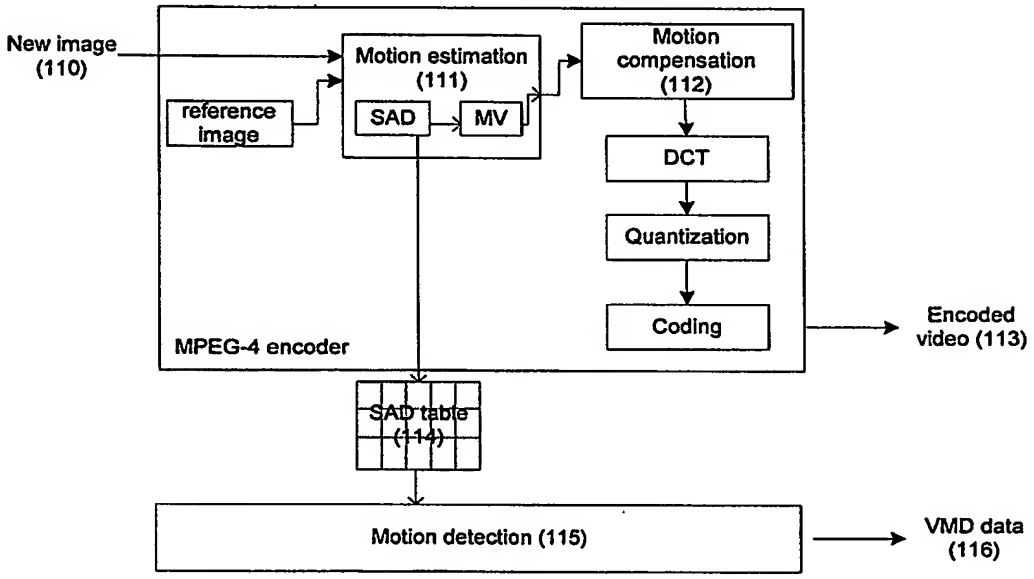

Figure 4: A block diagram of the data processing flow of the integrated MPEG-4 and VMD.

Text:

Figure 1 shows the regular data flow in a video streaming application: the raw (uncompressed) video images (1) go to both the MPEG-4 (2) and the VMD (4) modules. Both modules store a reference image, and both modules make calculations on the images. The results (the compressed video stream (3) and the VMD result (5)) go to the stream/event handler (6) for decision making and to the user.

Figure 2 shows how the same system works with the new method integrated the raw (uncompressed) video images (11) go only to the MPEG-4 module (12). The data needed for VMD is gathered and passed to the VMD module (17). The size of this data portion is 1/256 of the size of a regular image. The VMD module (14) then calculates the VMD result. Both the VMD data (15) and the compressed video stream (13) pass as before to the stream/event handler (16).

The motion estimation process in MPEG-4 encoding tries to estimates the amount of motion in every 16x16-pixel macroblock relative to the previous image. For doing this, it calculates the SAD – Sum of Absolute Differences:

$$SAD16(xc,yc,xr,yr) = \Sigma_{i,j=0..16}|C_{xc+i,yc+j} - R_{xr+i,yr+j}|$$

Where C is the current image and R is the previous one. When xc=xr and yc=yr the two macroblocks are in the same location. When there is a difference, they are not in the same location.

The encoding process tries to find the best fit in the immediate area of the macroblock. When there is no motion, the best SAD is in the same location. When there is motion, the best SAD is in another location. The Motion Estimation process finds the best match, and then derives the Motion Vector (MV), which describes the relocation vector from the current location to the new one. The Motion Estimation module does this process for every macroblock C(x,y) in the current image, and passes the MVs to the Motion Compensation module for further processing.

Figure 3 shows the internals of the MPEG-4 algorithm: we see the motion estimation module (101) calculating the SAD and the MV, and passing them on to the motion compensation module (102). The process continues and eventually the encoded video stream (103) is created.

Figure 4 shows the integration of the MPEG-4 with the VMD module using the proposed method. The only change relative to figure 3 is the SAD table (114): the motion estimation module places the SAD values of every macroblock in a designated table, and the table is then processed by the VMD module (115), to create the VMD data (116).

The VMD module is using the SAD table to derive the amount of motion in the whole image, relative to the previous one. To minimize the noise effect this process is accumulated over a number of successive images (currently – 10) and a weight function is added to emphasize the presence of large objects and minimize the effect of small isolated ones.

Advantages of the Invention over Prior Art:

Since the above algorithm saves processing time, it enables using less powerful (and cheaper) processors for the same task. For existing MVS-based applications it enables adding a motion detection feature for hardly no added development and processing power.

Innovative Steps:

The use MVS-based interim results for calculating VMD data, instead of a full implementation of a VMD algorithm. The required amount of calculations are between NxM/256 and NxM/100, instead of 2xNxM.

Glossary of Words and Acronyms:

MPEG-4: Moving Pictures Experts Group standard for encoding and decoding motion video.

VMD: Video Motion Detection.

Pixel: the smallest unit in a digital image.

Macroblock: a rectangular block in an image.

References:

The MPEG-4 Book, Fernando Pereira and Touradj Ebrahimi, ed. IMSC press, 2002.

CLAIMS

1. A method for simultaneously supporting of video motion detection and video compression, said method including the steps of:

providing a digital stream of video frames to the encoder;

extracting SAD table data by the encoder based on a comparison of frames;

performing video motion detection analysis based on the extracted SAD table data;

encoding video frame data of the digital stream by the encoder essentially concurrently while performing said extracting step; and

providing the encoded video frame data and video motion analysis to a stream/event handler.

2. A method according to claim 1 wherein said encoder is a motion vector search based encoder.

3. A method according to claim 2 is an encoder chosen from the group of encoders which include MPEG-2, MPEG-3, MPEG-4 and H. 264 encoders.

Background Questions For The Inventor(s)

(NEEDED TO FILL OUT THE REQUIRED FORMS)

The INVENTORS are defined as the individuals that provided a SOLUTION to a specific PROBLEM. It is preferable that the leading inventor will answer the questions.

I. General Questions About Inventors:

1) Who is/are the inventor(s)? For each inventor, give full name, work location, telephone number, email address, the date the inventor started to work at SERVISION (at least month and year), home address, home mailing address (if different), country of citizenship (or countries of citizenship, if there are more than one), and manager's name.

Name of Inventor	1) Dror Heller	2) Yosef Rotman
Work Location	SerVision	SerVision
Work Number		
Work E-mail	dheller@servision.net	yosefr@servision.net
Start Date at SERVISION	January 2003	March 2002
Home & mailing address	14 November 29th, Jerusalem, ISRAEL	23/1 Shlomo St. Jerusalem, ISRAEL
Country of Citizenship	Israel	Israel
Manager's	Gidon Tahan	Gidon Tahan

2) If there are more than one inventors, what did each inventor contribute to the invention?

Inventor 1: **Design and implementation**

Inventor 2: **Ideas and consulting.**

3) Are there inventors who do not work at SERVISION today? If so:

a) Who are they?

b) Where do they work now?

c) Did they at work at SERVISION at any time during the conception or implementation of the invention?

d) If so, what are the dates that they started and stopped working at SERVISION?

II. History of the Invention:

[The idea here is to let the Attorneys know how the idea developed and at what stage of development the idea is today. The questions below should be answered very briefly.]

1) What is the current stage of the idea? Select one: Concept _____; Analysis _____; Design _____; Prototype _____; Bench Test/Alpha Test _____; Pilot Run/Beta Test _____**X**_____; Commercial Production _____.

2) Conception of the idea:

a) When did the inventors get the idea for the invention (approximately, if the exact date is not known)? **June 2003**

b) Where did this happen? **SerVision**

c) Where there any non-inventors present when the idea was created? **No**

d) If so, who?

3) First sketch or drawing: **August 2003**

a) When was the first sketch or drawing of the idea made? **SerVision**

b) Who made it? **Dror Heller**

c) If you have a copy of the first sketch or drawing, please attach it.

4) First model or prototype: **August 2003**

a) Was a model or prototype of the idea made? **Yes**

b) If so, when was the model or prototype completed? **Sept 2003**

c) If this is being done now, when do you expect to complete the model or prototype?

5) Alpha testing:

a) Was the idea alpha tested? **Yes**

a) Who performed the alpha test? **Dror Heller**

b) When was the idea alpha tested? **August 2003**

c) Apart from the inventors, who else was present during the alpha testing of the idea? **None**

d) Where was the idea alpha tested? **SerVision**

6) Beta testing (at a customer site or partner site):

a) Was the idea beta tested? **No**

e) Who performed the beta test?

f) When was the idea beta tested?

g) Apart from the inventors, who else was present during the beta testing of the idea?

h) Where was the idea beta tested?

7) Has the idea been produced commercially? If so, when, how many units were produced (approximately), by who (that is, who was the manufacturer), and for who (that is, who was the customer)? **No**

8) Does this invention impact the project you are working on? **Yes.** If so:

a) How does the invention impact on your project? **It enables adding VMD with almost no added computational power.**

b) How would you categorize the amount of the impact on your project?

VITAL [ ] IMPORTANT [**X**], or HELPFUL [ ]

(REMEMBER, A PATENT DOES NOT NEED TO BE AN INVENTION OF A TOTALLY NEW INDUSTRY. IT SIMPLY NEEDS TO BE SOMETHING NEW THAT HAS SOME TECHNICAL OR COMMERCIAL VALUE. SMALL OR MODERATE IMPROVEMENTS MAKE UP THE VAST MAJORITY OF ALL PATENTS, AND HIGHLY REGARDED BY SERVISION.)

c) Why did you pick that category for the impact on your project?

Adding a full VMD algorithm would take cmoputational power the system does not have. So any other algorithm will degrade the system's performance.

9) Apart from any impact the invention may have on your project, does this invention impact the Company's technology in general? **No.** If so:

a) How does the invention impact on your project?

It saves development time and adds features not without too much development effort.

b) How would you categorize the amount of the impact on your project?

VITAL [ ] IMPORTANT [**X**], or HELPFUL [ ]

(AGAIN, THE GREAT MAJORITY OF PATENTS ARE SMALL OR MODERATE IMPROVEMENTS, WITH SOME TECHNICAL OR COMMERCIAL VALUE. ALL THESE PATENTS ARE RESPECTED AND REWARDED BY SERVISION.)

c) Why did you pick that category for the impact on the Company's technology?

10) Prior Practice:

a) Was the invention practiced before in SERVISION? If so, describe the circumstances? **No**

b) Was the invention practiced before at some place other than elsewhere? If so, describe the circumstances? **No**

c) Have you seen this solution in writing in the professional media? **No**

d) Have you performed a patent search? **No** If so, did you find any patents that were relevant to the invention (even if they weren't exactly the same)? If so, what the numbers of those patents? (Attach copies of whatever relevant patents you have.) Even if you have not performed a patent search, have you seen this idea described in a different patent?

e) Have you seen a similar idea described anywhere else? **No** If so, under what circumstances? (That is, a competitor's product, an advertisement, a trade show, etc.)

f) Do you have regular access to trade magazines, technical articles? Do visit trade shows, or do you get trade show information from other people? **Yes**

g) Where did you get the idea? **At work**

III. Contacts with Outside Parties:

1) Up to the date you fill out this form, did you or anyone else you know of ever discuss the idea of the invention or the invention itself with anyone outside of SERVISION? **No.** If so:

a) With whom outside of SERVISION?

b) When?

c) Where?

d) What were the circumstances? (Discussion of idea, or product demonstration, or market research, or testing, or joint development, or offer to sell, or sale, etc.)

e) Were samples supplied?

f) Were written drawings or diagrams supplied?

g) At the time of each such contact with an outside party, did SERVISION have a Non-Disclosure Agreement between SERVISION and the party? If so, do you have this Agreement or do you know who does have the Agreement? (If you have it, please attach a copy.)

2) Did you or anyone else at SERVISION make an oral or written offer to sell? If so, please describe this offer, including name of potential customer, price offered, result of the offer, etc. **No**

3) Do you or anyone you know of plan to discuss the idea of the invention or the invention itself with anyone outside of SERVISION within the next six (6) months? If so, what will be the circumstances of this discussion? (Again, include any planned discussion, demonstration, market research, testing, joint development, offer to sell, intent to sell, etc.) **No**

4) Up to the date you fill out this form, was the idea ever published publicly? **No.** Does the idea appear in any SERVISION promotional literature? Does the idea appear in any article or paper that was published? Was the idea ever presented at a trade show?

5) Up to the date you fill out this form, was there ever any other public announcement or other revelation of the idea of the invention or the invention itself? **No** If so, when and under what circumstances? (An article, a trade show, a meeting, etc.)

6) Do you know if anyone is planning any public announcement or other public revelation of the idea of the invention or the invention itself over the next six (6) months? **No** If so, when and under what circumstances?

SERVISION LTD.
513052324
JERUSALEM ISRAE

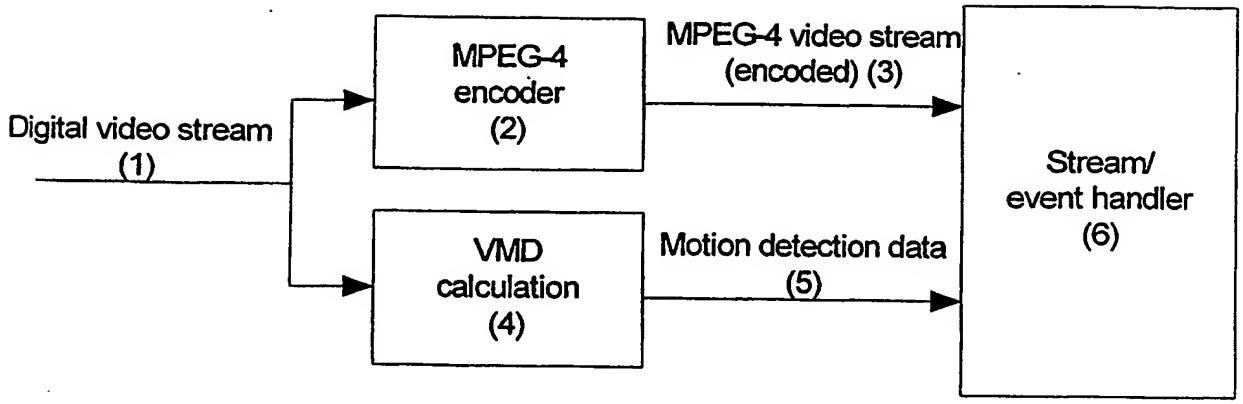

Figure 1: A block diagram of a video streaming application with VMD.

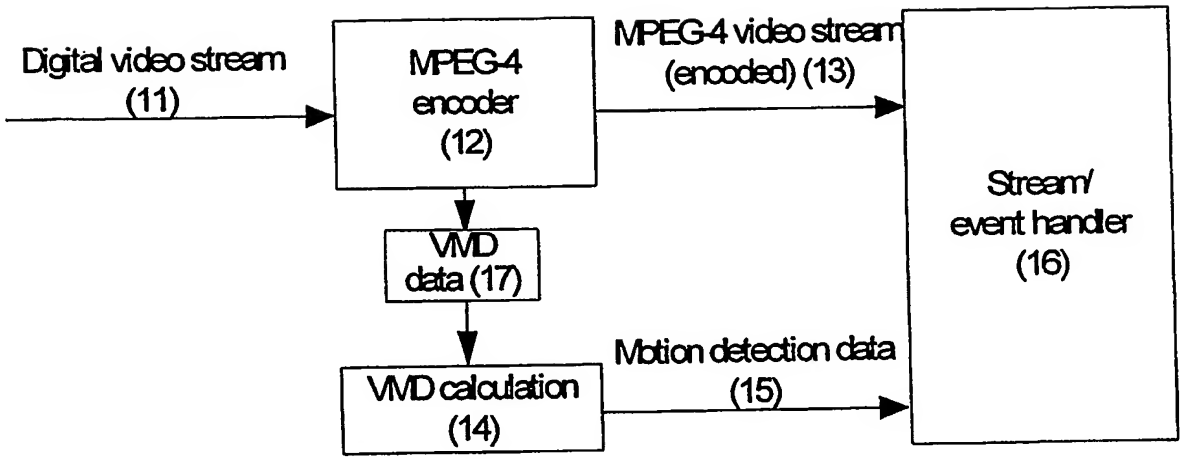

Figure 2: A block diagram of a video streaming application with VMD, new algorithm used.

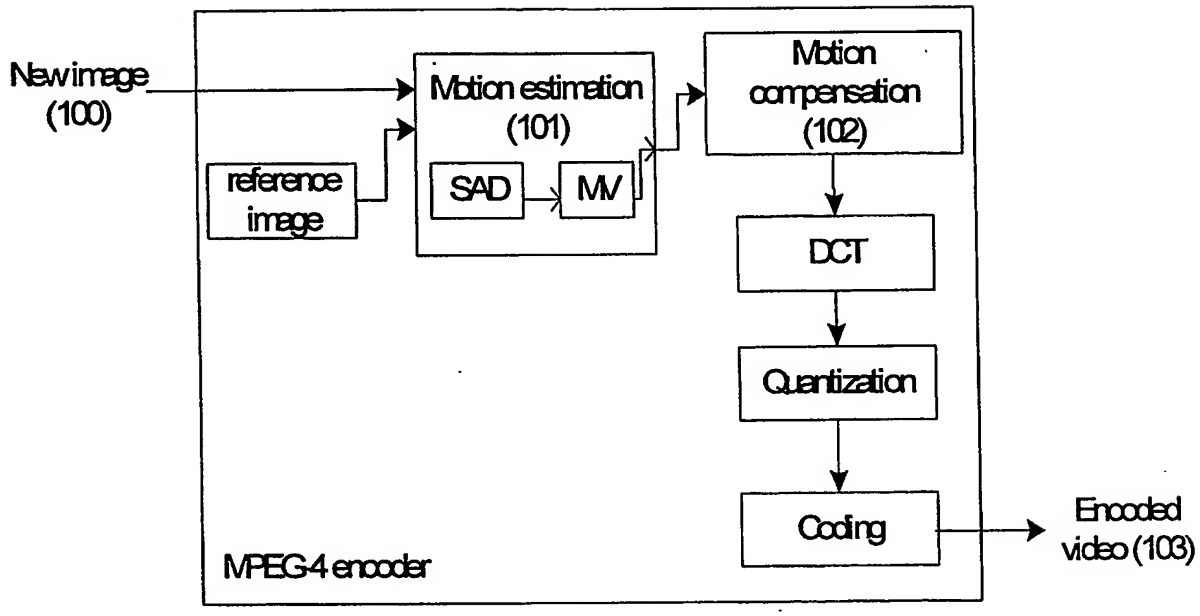

Figure 3: A block diagram of MPEG-4 data processing flow.

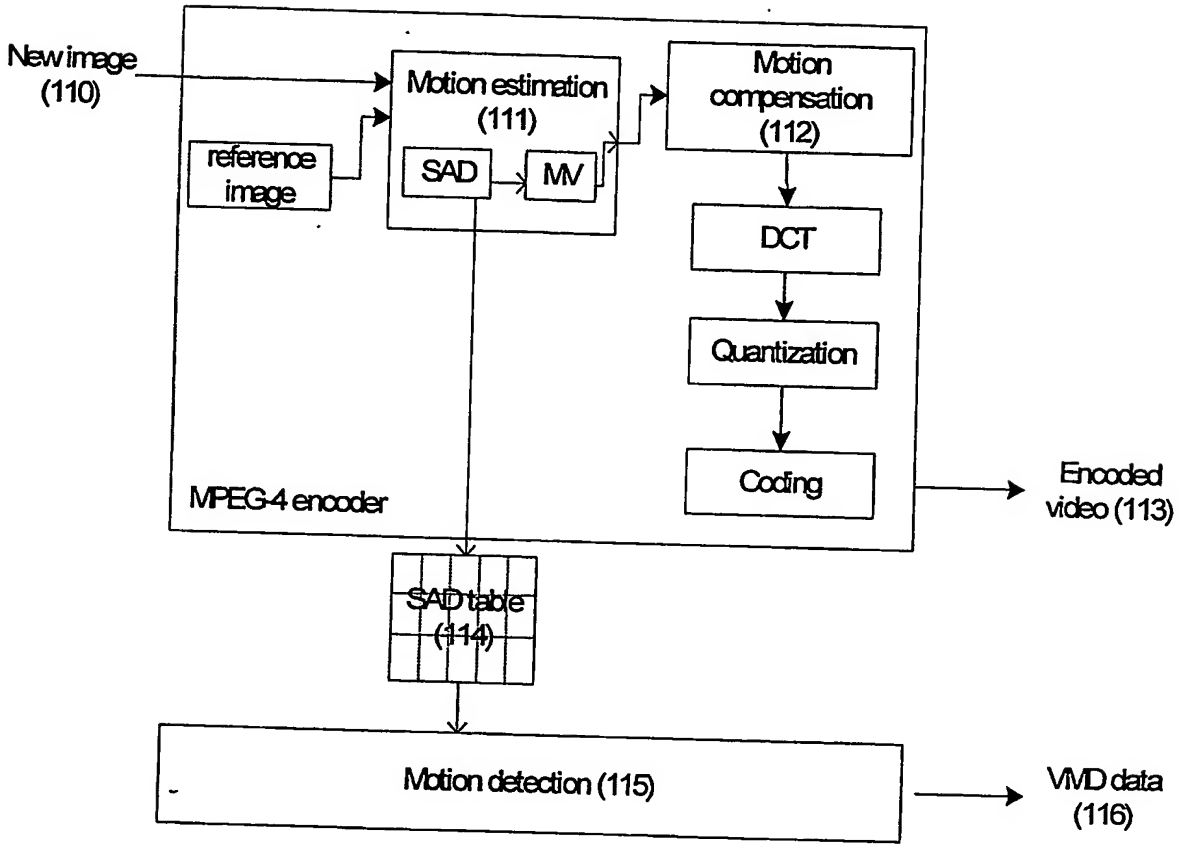

Figure 4: A block diagram of the data processing flow of the integrated MPEG-4 and VMD.

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/IL04/000867

International filing date: 20 September 2004 (20.09.2004)

Document type: Certified copy of priority document

Document details: Country/Office: IL
Number: 158024
Filing date: 21 September 2003 (21.09.2003)

Date of receipt at the International Bureau: 10 January 2005 (10.01.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)